STGD6NC60HD

N-CHANNEL 6A - 600V DPAK
Very Fast PowerMESH™ IGBT

TARGET SPECIFICATION

Table 1: General Features

TYPE	V_{CES}	$V_{CE(sat)}$ (Max) @25°C	I_C @100°C
STGD6NC60HDT4	600 V	< 2.5 V	6 A

- LOWER ON-VOLTAGE DROP (V_{cesat})
- OFF LOSSES INCLUDE TAIL CURRENT
- LOSSES INCLUDE DIODE RECOVERY ENERGY
- LOWER C_{RES}/C_{IES} RATIO
- HIGH FREQUENCY OPERATION
- VERY SOFT ULTRA FAST RECOVERY ANTI PARALLEL DIODE
- NEW GENERATION PRODUCTS WITH TIGHTER PARAMETER DISTRIBUTION

Figure 1: Package

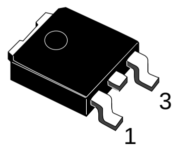
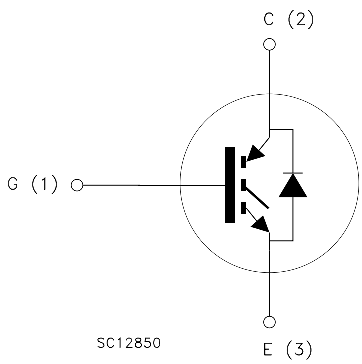


Figure 2: Internal Schematic Diagram



DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "H" identifies a family optimized for high frequency applications in order to achieve very high switching performances (reduced tfall) maintaining a low voltage drop.

APPLICATIONS

- HIGH FREQUENCY INVERTERS
- SMPS AND PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES
- MOTOR DRIVERS

Table 2: Order Code

PART NUMBER	MARKING	PACKAGE	PACKAGING
STGD6NC60HDT4	GD6NC60HD	DPAK	TAPE & REEL

Rev. 1

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-Emitter Voltage (V_{GS} = 0)	600	V
V_{ECR}	Emitter-Collector Voltage	20	V
V_{GE}	Gate-Emitter Voltage	±20	V
I_C	Collector Current (continuous) at T_C = 25°C (#)	10	A
I_C	Collector Current (continuous) at T_C = 100°C (#)	6	A
I_{CM} (⊠)	Collector Current (pulsed)	24	A
I_F	Diode RMS Forward Current at T_C = 25°C	TBD	A
P_{TOT}	Total Dissipation at T_C = 25°C	50	W
	Derating Factor	0.40	W/°C
T_{stg}	Storage Temperature	– 55 to 150	°C
T_j	Operating Junction Temperature		

(⊠) Pulse width limited by max. junction temperature.

Table 4: Thermal Data

		Min.	Typ.	Max.	
Rthj-case	Thermal Resistance Junction-case			2.5	°C/W
Rthj-amb	Thermal Resistance Junction-ambient			100	°C/W
T_L	Maximum Lead Temperature for Soldering Purpose (1.6 mm from case, for 10 sec.)		275		°C

ELECTRICAL CHARACTERISTICS (T_{CASE} =25°C UNLESS OTHERWISE SPECIFIED)

Table 5: Main Parameters

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-Emitter Breakdown Voltage	I_C = 1 mA, V_{GE} = 0	600			V
I_{CES}	Collector cut-off Current (V_{GE} = 0)	V_{CE} = Max Rating, T_C = 25 °C V_{CE} = Max Rating, T_C = 125 °C			10 1	µA mA
I_{GES}	Gate-Emitter Leakage Current (V_{CE} = 0)	V_{GE} = ± 20V , V_{CE} = 0			±100	nA
$V_{GE(th)}$	Gate Threshold Voltage	V_{CE} = V_{GE}, I_C = 250 µA	3.75		5.75	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE} = 15V, I_C = 3 A V_{GE} = 15V, I_C = 3 A, Tc= 125°C		1.9 1.7	2.5	V V

(#) Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{JMAX} - T_C}{R_{THJ-C} \times V_{CESAT(MAX)}(T_C, I_C)}$$

ELECTRICAL CHARACTERISTICS (CONTINUED)

Table 6: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	V_{CE} = 15 V , I_C = 3 A		TBD		S
C_{ies} C_{oes} C_{res}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{CE} = 25 V, f= 1 MHz, V_{GE} = 0		320 28 7.2		pF pF pF
Q_g Q_{ge} Q_{gc}	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V_{CE} = 390 V, I_C = 3 A, V_{GE} = 15 V (see Figure 5)		15 TBD TBD	TBD	nC nC nC
I_{CL}	Turn-Off SOA Minimum Current	V_{clamp} = 480 V , Tj = 150°C R_G = 10 Ω, V_{GE} = 15 V	TBD			A

(1) Pulsed: Pulse duration= 300 µs, duty cycle 1.5%

Table 7: Switching On

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on Delay Time Current Rise Time Turn-on Current Slope	V_{CC} = 390 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15V, Tj= 25°C (see Figure 3)		TBD TBD TBD		ns ns A/µs
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on Delay Time Current Rise Time Turn-on Current Slope	V_{CC} = 390 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15V, Tj= 125°C (see Figure 3)		TBD TBD TBD		ns ns A/µs

Table 8: Switching Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off Voltage Rise Time Turn-off Delay Time Current Fall Time	V_{cc} = 390 V, I_C = 3 A, R_G = 10 Ω , V_{GE} = 15 V T_J = 25 °C (see Figure 3)		TBD TBD 70		ns ns ns
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off Voltage Rise Time Turn-off Delay Time Current Fall Time	V_{cc} = 390 V, I_C = 3 A, R_G = 10 Ω , V_{GE} = 15 V Tj = 125 °C (see Figure 3)		TBD TBD TBD		ns ns ns

Table 9: Switching Energy

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
Eon (2) E_{off} (3) E_{ts}	Turn-on Switching Losses Turn-off Switching Loss Total Switching Loss	V_{CC} = 390 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15V, Tj= 25°C (see Figure 3)		TBD TBD TBD		µJ µJ µJ
Eon (2) E_{off} (3) E_{ts}	Turn-on Switching Losses Turn-off Switching Loss Total Switching Loss	V_{CC} = 390 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15V, Tj= 125°C (see Figure 3)		TBD TBD TBD		µJ µJ µJ

(2) Eon is the turn-on losses when a typical diode is used in the test circuit in figure 2. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode. IGBTs & DIODE are at the same temperature (25°C and 125°C)
(3) Turn-off losses include also the tail of the collector current.

Table 10: Collector-Emitter Diode

Symbol	Parameter	Test Condiction	Min.	Typ.	Max.	Unit
V_f	Forward On-Voltage	If = 1.5 A If = 1.5 A, Tj = 125 °C		1.6 1.3	2.1	V V
t_{rr} t_a Q_{rr} I_{rrm} S	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current Softness factor of the diode	If = 1.5 A, V_R = 40 V, T_j = 25 °C, di/dt = 100 A/µs (see Figure 6)		TBD TBD TBD TBD TBD		ns ns nC A
t_{rr} t_a Q_{rr} I_{rrm} S	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current Softness factor of the diode	If = 1.5 A, V_R = 40 V, T_j = 125 °C, di/dt = 100 A/µs (see Figure 6)		TBD TBD TBD TBD TBD		ns ns nC A

Figure 3: Test Circuit for Inductive Load Switching

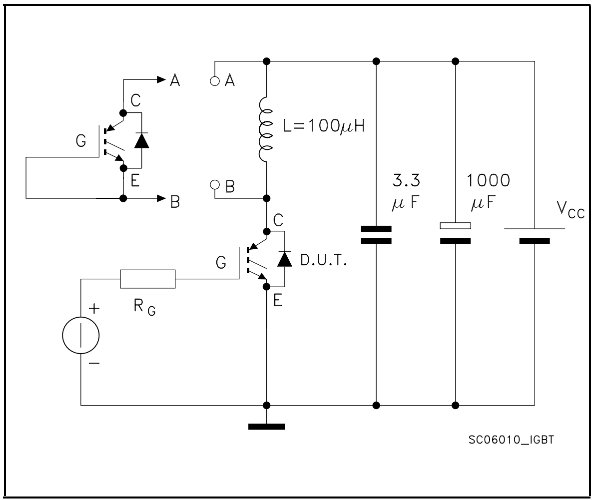


Figure 5: Gate Charge Test Circuit

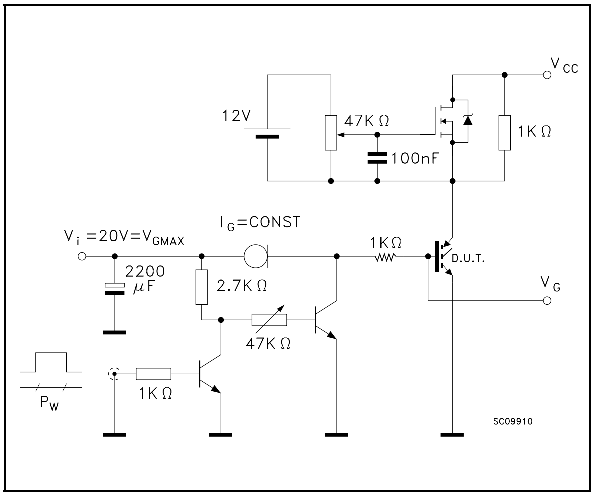


Figure 4: Switching Waveforms

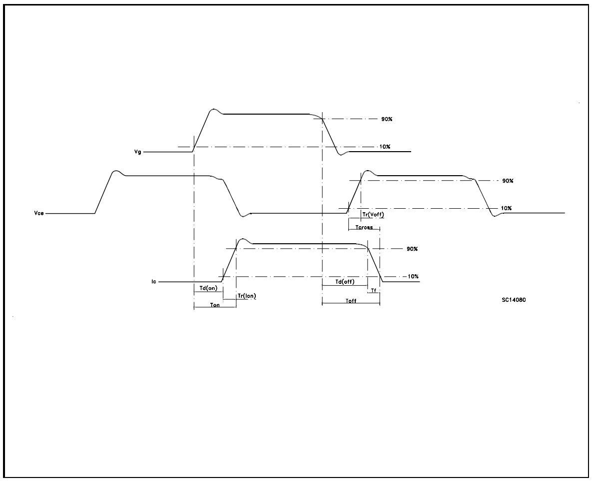
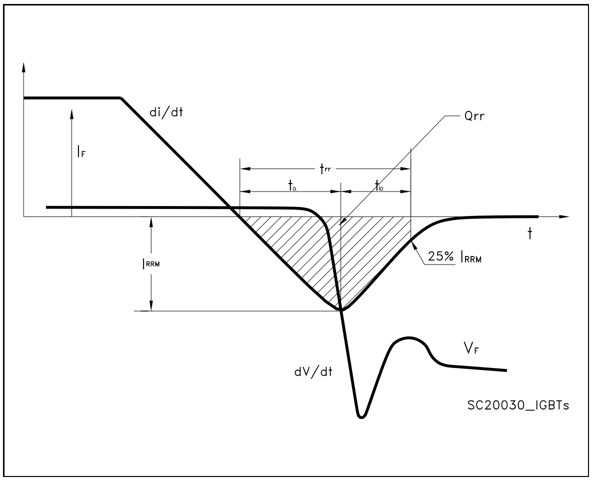
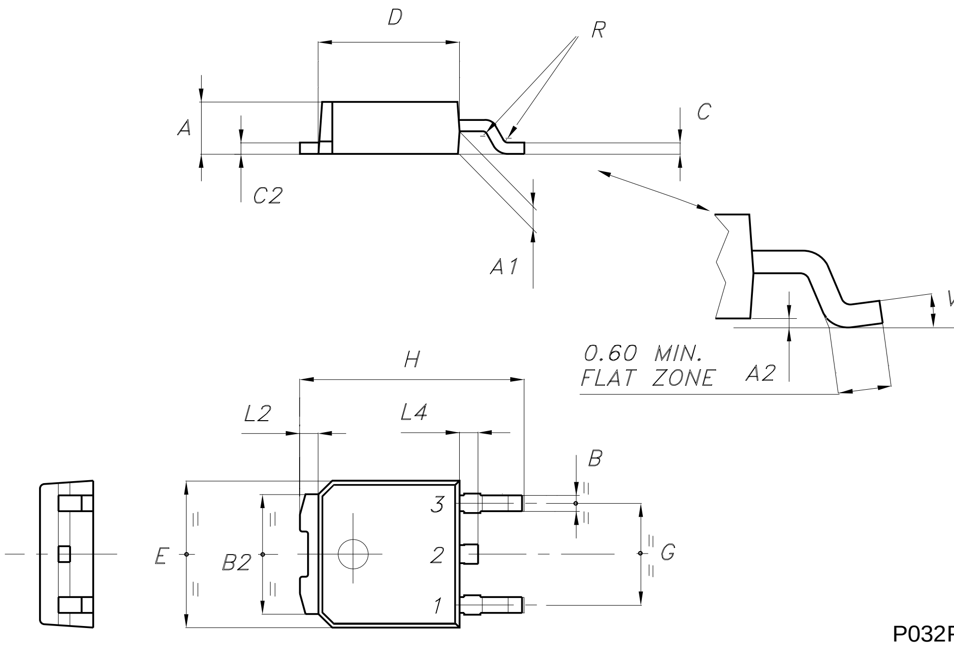


Figure 6: Diode Recovery Time Waveforms



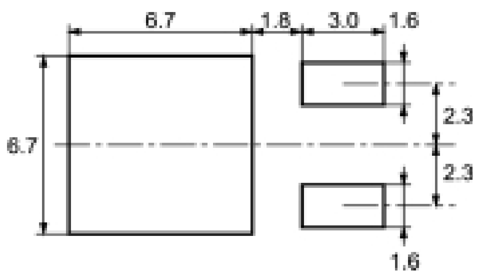
TO-252 (DPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.213
C	0.45		0.60	0.018		0.024
C2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
E	6.40		6.60	0.252		0.260
G	4.40		4.60	0.173		0.181
H	9.35		10.10	0.368		0.398
L2		0.8			0.031	
L4	0.60		1.00	0.024		0.039
V2	0°		8°	0°		0°



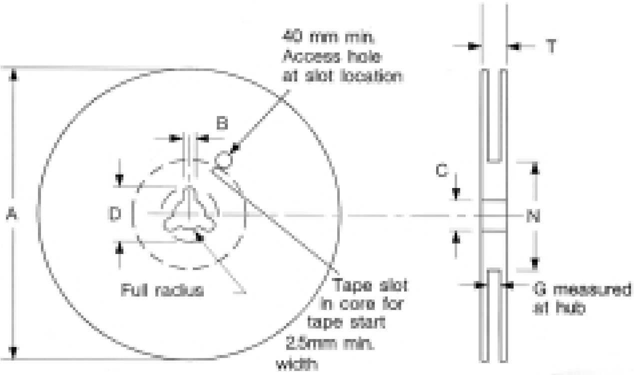
P032P_B

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



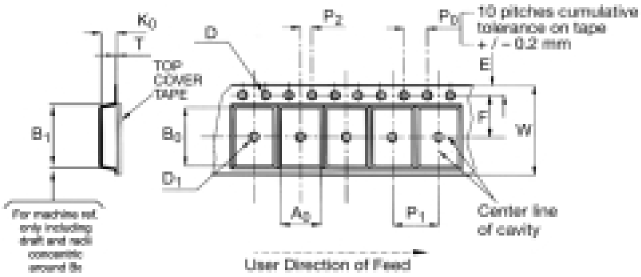
REEL MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

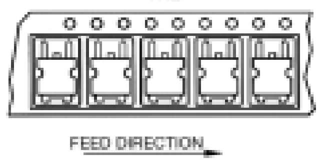
BASE QTY	BULK QTY
2500	2500

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641



TRL



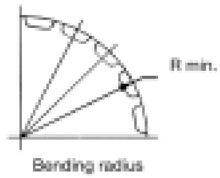


Table 11: Revision History

Date	Revision	Description of Changes
14-Jun-2005	1	First release